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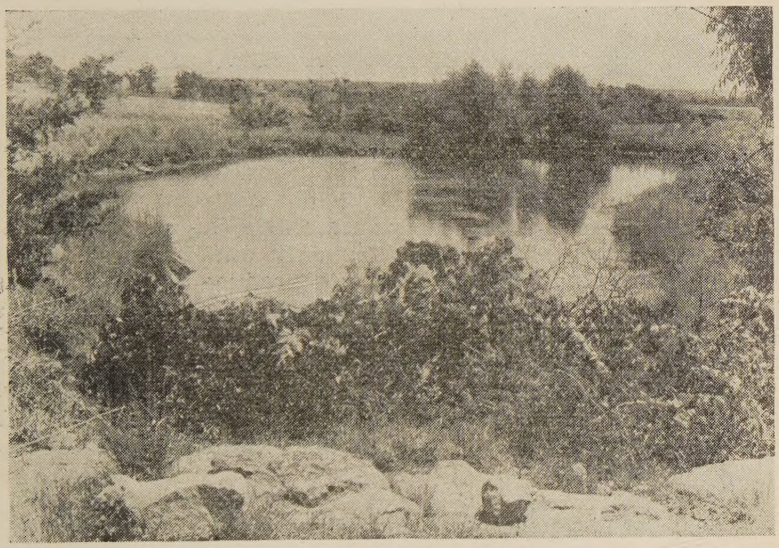

Photograph by J. H. B. DeGruchy.

An excellent growth of vegetation on the shores and watershed of a farm pond that has been protected from grazing. A tank below the dam, or proper fencing, permits use of a pond for both fish production and stock watering.

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Fish Production in Farm Ponds

By A. D. ALDRICH, F. M. BAUMGARTNER, and W. H. IRWIN*

An ever-increasing number of inquiries concerning the proper management of ponds for fish production is being received by the Oklahoma Agricultural Experiment Station. This circular was prepared to answer some of the more important questions.

How much fish a farm pond will produce depends upon the fish food available as well as on the size of the pond. Farm ponds properly constructed and managed have produced 100 to 300 pounds of fish per surface acre of water each year. If properly fertilized, the production should increase to 300 to 600 pounds per acre.

THE NEED OF FISH FOOD

The most serious and common mistake in attempting to raise fish is trying to grow a larger number than the amount of food available will support. A thousand fish cannot be expected to grow to full size in a pond that has food for only one hundred, any more than a thousand cattle can put on weight in a pasture that has forage for only one hundred. It is possible for one pair of black bass to produce so many young that the offspring will require more food than is available in a pond. The inevitable result will be a pond filled with stunted, starved fish that never grow large enough to be of use (Fig. 1).

The basic food for all fish consists of microscopic plants and animals. These minute forms are eaten by small fish and other water-inhabiting animals, which in turn become food for the larger fish.

REQUIREMENTS OF PONDS

SIZE.—Generally speaking, ponds ranging in size from one to five surface acres are best adapted for raising fish. Smaller ponds do not support enough food to raise many fish. Larger ones require more care and are more difficult to improve if conditions become unfavorable for fish.

WATER SUPPLY.—The ideal farm fish pond has a sufficient supply of water to maintain a fairly constant water level throughout the year. Clear water is much more desirable than muddy or turbid water. Spring or stream fed ponds, or ponds that are supplied from wells, are best.

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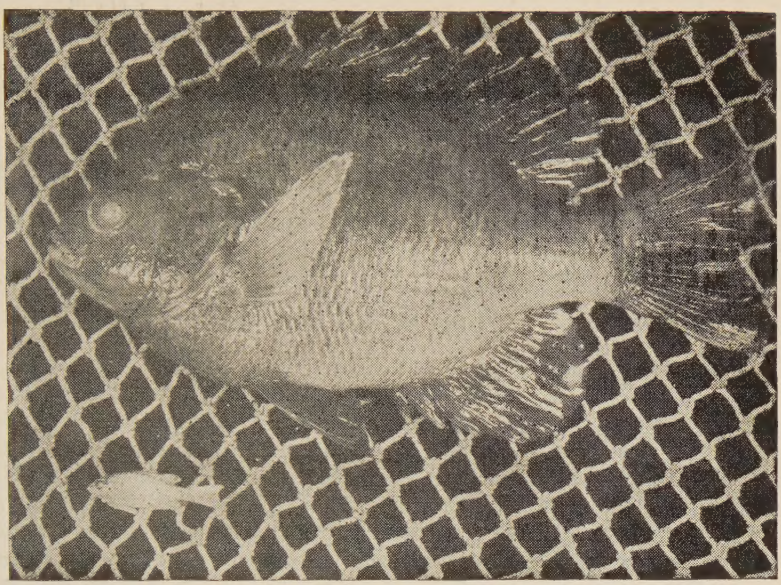

Figure 1.—Effect of Rates of Stocking on Size of Bluegills.
(Courtesy Alabama Agricultural Experiment Station.)
Both fish were taken one year after the ponds were stocked. The large fish is from a pond stocked with 1,500 bluegills per acre; the fish averaged 4 ounces. The small fish is from a pond stocked with 180,000 bluegills per acre; the fish averaged 2/100th ounce. Growth of fish is stunted if there are too many fish for the amount of food available.

Ponds that are not fed by running water should be at least eight feet deep over about one-third of the pond area. The remaining two-thirds should be moderately shallow, from two to four feet deep. Shallow water is necessary for spawning and for production of the water-inhabiting plants which contribute to the food supply for growing fish. Ponds that lack shallow water or are subject to violent fluctuation in water depth are therefore unsatisfactory.

Overgrazing of the watershed is to be avoided to prevent excessive muddying of water in the ponds.

PLANT GROWTH.—Fish ponds need a good growth of plants in the shallow water and on the shores. Plant growth in shallow water furnishes spawning sites and places for young fish to feed and to escape from larger fish and other natural enemies. Shoreline vegetation acts as a barrier to erosion of the soil that is brought down from the watershed by rains. However, a pond choked with vegetation is not desirable.

FENCING.—If possible, stock should be completely fenced from the shore of the pond and allowed to drink from a tank below the dam. Stock wading in the pond not only muddy the water but also destroy vegetation in the water and along the shore. The cover picture shows the desirable heavy growth of vegetation that can be expected when ponds are fenced.

If it is not practical to fence stock from the whole pond, it is still possible to protect part of the shore line. Two fences can be built, one enclosing the dam and spillway and the other the upper part of the pond and the channels that carry the water from the watershed. If only one fence is used, it should enclose the area most productive for fish and other wildlife, which is the upper portion of the pond where the water is shallow.

DRAINAGE.—It is helpful to have a drain pipe through the dam so that the pond can be completely drained.* This is sometimes necessary to remove undesirable fish, to harvest fish for market, or to relieve overstocking due to exceptionally favorable spawning conditions. When more fish hatch in a pond than the available food will support, the only sure way to correct the situation is to drain the pond and remove the excess fish.

If the water must be kept in the pond for other purposes, some of the suggestions given below for restoring the balance between food and fish can be tried; but none is entirely successful.

STOCKING WITH FISH

Figure 1 shows the effects of proper stocking with bluegills and of overstocking with this species. Some new ponds that are badly overstocked never produce a good crop of fish. It may be desirable to reduce the number of fish planted in a new pond until the vegetation surrounding the pond is well established. This should take at least one growing season.

The kinds, number and combinations of fish used in stocking depend somewhat on the types of fish desired. If food is the main consideration, carp will provide the greatest yield because they feed on practically all kinds of plant and animal matter. If sport is desired in addition to food, every means available should be used to keep carp out of the pond.

It is doubtful if more than a few kinds or combinations of fish will produce and maintain good fish production in the average farm pond. The large species of catfish, smallmouthed bass, rock bass and other sunfish commonly called perch frequently offer too much competition for food and

* Before draining a pond to remove fish for any purpose, the local game warden should be consulted. Certain kinds of fish cannot be legally taken in this manner.

shelter and lead to an overstocked pond. Consequently every effort should be made to keep them out of a pond where high production is desired.

GAME FISH.—Table I suggests a stocking plan for new ponds that has proved successful in Alabama.* As indicated, if white crappie and bullhead catfish are included, the number of largemouth black bass and bluegill sunfish should be reduced. This is the only plan known to the authors that has maintained high production of game fish over a long period of years. It may require some changes for Oklahoma conditions, but undoubtedly indicates a rate of stocking that will produce some fishing in the better farm ponds.

TABLE I.—Rate of Stocking Farm Fish Ponds; Number of Fingerlings per Surface Acre.

	In Unfertilized Water	In Fertilized Water
Largemouth Black Bass	30	150
Bluegill Sunfish	400	1500
White Crappie	8 (reduce the number of bass to 22)	12 (reduce the number of bass to 38)
Bullhead Catfish	25 (reduce the number of bluegill to 300)	100 (reduce the number of bluegill to 1100)

All fish stocked should be fingerlings of uniform size. Be certain that the forage fish are true bluegills exclusive of the other kinds of sunfish commonly known as perch.

Ponds should be stocked in the late summer or fall in order to give the fingerlings time to develop and spawn successfully the following spring.

In ponds already supplied with fish, either by natural or artificial stocking, no plan can be laid down that will apply generally. However, it should be kept in mind that the purpose of a stocking plan is to develop a balance between carnivorous or flesh-eating fish (such as bass and crappie) and forage or plant and small animal eating species (such as bluegill and bullhead).

If fishing shows that the forage fish are too plentiful, fish or seine out some of them. On the other hand, in ponds where bass can be caught in considerable numbers but run small in

* Bulletin 254, Alabama Agricultural Experiment Station.

size and low in weight, there is likely to be a lack of forage fish for their food. In this case reduce the number of bass by heavy fishing. It is not likely that the pond will be over fished by this method and a balance can better be maintained by thinning than by further stocking. Most ponds two or three years old tend to become overstocked for the available fish food. Certainly repeated stocking will result in more fish than the food can maintain.

CARP.—Carp ponds should be stocked in the early spring, preferably before March 1. Adult carp can be readily caught from most streams, ponds or lakes. A stocking rate of three or four males and six to eight females per surface acre of water is recommended. After the fish have spawned it is best to remove them from the pond.

FERTILIZATION

Fertilization of water to increase fish crops has been practiced for centuries in China and other Old World countries. Fertilization increases the production of plants and small animals that form the basic food of fish. To avoid contamination when fertilizing, it is desirable to water stock from a tank below the dam and completely fence the pond.

KIND OF FERTILIZER.—Ordinary stable manure is a practical fertilizer. (Horse manure offers less opportunity for the spreading of stock diseases than some of the other kinds.) Old hay, or weeds cut from pastures, offer an excellent and inexpensive fertilizer; such material can be piled at the water's edge and used as needed. Or it may be more convenient to use cottonseed meal or soybean meal, when obtainable. When any of these fertilizers are used, phosphate and potassium should also be used for best results.

A commercial fertilizer having a 4-2-1 nitrogen, phosphorus, potassium ratio also might be used.* If intensive fish production is wanted, a chemical analysis of the water should be obtained to determine what specific elements are deficient and commercial fertilizers used to provide those which are lacking.

AMOUNT OF FERTILIZER.—Table II indicates the average number of pounds of fertilizer per surface acre of pond, and dates of application. The figures given will vary with conditions. Fertilizers must be added in accordance with the weather and already existing fertility of the water. Over-fertilization during hot weather will kill both fish and fish food. Water

* Fertilizers with a 4-2-1 ratio are not at present available commercially in ready-mixed form. Instruction for preparing this mixture may be obtained from the Department of Agromony, Oklahoma A. and M. College.

TABLE II.—Fertilization Schedule for Farm Fish Ponds.
(Pounds per surface acre)

Date of Application	FERTILIZER				
	NITROGEN*			Phosphorus:** 16% Superphosphate	Potassium:** Muriate of Potash
	Hay OR	Barnyard Manure OR	Cottonseed or Soybean Meal		
March 15	800	400	200	40	8
March 25	600	300	150	30	6
April 5	400	200	100	20	4
April 15	400	200	100	20	4
April 25	400	200	100	20	4
May 5	400	200	100	20	4
May 15	200	100	50	10	2
May 25	200	100	50	10	2
June 5	200	100	50	10	2
June 15	200	100	50	10	2
September 10	200	100	50	10	2
September 25	400	200	100	20	4

* Any one of these three nitrogen fertilizers may be used, depending upon availability.
** These should be added to the nitrogen fertilizer.

should "bloom," that is, become green with tiny specks of algae. If the water becomes foul and heavily stained after applying fertilizers, discontinue the fertilization until time has corrected this condition, then reduce the next application.

A good crop of algae is a desirable condition unless floating algae blanket the entire surface of the water enough to cut off the supply of oxygen from the air. It is sometimes necessary to skim blanket algae from the water. This can be done with an ordinary lawn rake from the windward side of the pond.

The fertilizer should be scattered uniformly throughout the shallow water areas of the pond.

HARVESTING THE FISH CROP

The belief that the amount of fishing must be rigidly restricted is a common mistake. Continued fishing is good for most ponds. In fact there is some evidence which suggests that a pond is not likely to be overfished by ordinary methods. In a new pond the fingerlings should reach legal size the summer following the fall in which they are stocked. When these fish have reached legal size, the pond should be opened to fishing.

The laws of Oklahoma limit the removal of fish from most ponds to standard methods of fishing with hook and line. Furthermore, legal size and daily limits have been set

for game fish. However, ponds that receive all of their water from the owner's land and have not been stocked by the Game and Fish Department are classed as private ponds and are not subject to these laws.*

A careful check should be made on the catch of both the carnivorous fish (bass and crappie) and the forage fish (bluegills and bullheads). If the carnivorous fish can be caught readily and the bluegills and bullheads are seldom caught, encourage bass and crappie fishing and limit fishing for forage species until they become plentiful again. On the other hand, if the bluegills and bullheads become very plentiful, these species should be fished heavily and the bass fishing restricted. If both groups of fish appear to be making a poor growth (indicated by the large heads and short, thin bodies) the pond should be thrown open and heavy fishing of all species encouraged.

Carp can best be removed from a pond by trapping as needed, or by hook and line fishing using doughballs as bait. If the carp pond can be drained it is desirable to remove all of the fish when they weigh two or three pounds. They should reach this size by the second summer after the pond has been stocked. If carp do not show such a good growth the number should be materially reduced until a balance is obtained between their food requirements and the amount of available food.

USEFUL PUBLICATIONS

Costs and methods of constructing farm ponds are given in Oklahoma Extension Circular No. 175, "The Farm Pond," available free from county agents or by writing: Mailing Room, Extension Division, Oklahoma A. and M. College, Stillwater, Oklahoma.

Information on the establishment and protection of vegetation in and surrounding farm ponds is given in U. S. Farmers' Bulletin No. 1879, "Ponds for Wild Life," obtainable from the Superintendent of Documents, Washington, D. C.; price 10 cents.

A general discussion of farm fish ponds will be found in Alabama Experiment Station Bulletin No. 254, "Management of Farm Fish Ponds," obtainable from the Alabama Station at Auburn.

A description and evaluation of the aquatic plants for fish culture is given in Oklahoma Experiment Station Technical Bulletin No. 4, "A Preliminary Study of the Larger Aquatic Plants of Oklahoma With Special Reference to Their Value in Fish Culture," available free by writing: Mailing Room, Experiment Station, Oklahoma A. and M. College, Stillwater, Oklahoma.

* Sec. 4779 of the Oklahoma Statutes, 1931, defines private ponds and the regulations that apply to them.